A PROPOSED REFERENCE SECTION FOR THE TORTACHILLA LIMESTONE

by A. S. BEECROFT*, J. H. CANN† & C. STOCKSIEK‡

Summary

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Roadside outcrops of sedimentary rocks near Port Noarlunga, South Australia, are identified as Late Eocene stratigraphic units of the Noarlunga Embayment within St Vincent Basin. Fossil planktonic and benthic foraminifera from these rocks compare favourably with stratotype Tortachilla Limestone and the Tuketja Member of Blanche Point Formation. An exposure of highly fossiliferous, glauconitic calcarenite, bounded below by the South Maslin Sand Member of Maslin Sands, and above by the Tuketja Member of Blanche Point Formation, is proposed as a reference section for Tortachilla Limestone.

KEY WORDS: Eocene, foraminifera, Noarlunga Embayment, St Vincent Basin, Tortachilla Limestone.

Introduction

The Tortachilla Limestone is a Late Eocene stratigraphic Member of St Vincent Basin (Reynolds 1953; Stuart 1970; Buonaiuto 1977; Cooper 1979; Beecroft 1980[1]; Jenkins *et al.* 1982). Within the Willunga Embayment, at the type locality, Maslin Bay, the Tortachilla Limestone has a maximum thickness of about two metres. It overlies the poorly fossiliferous South Maslin Sand Member of the Maslin Sands (Cooper 1979) and is in turn overlain by the younger Tuketja Member of the Blanche Point Formation (Jenkins *et al.* 1982). Buonaiuto (1977) confined the Tortachilla Limestone to the lower Polyzoal Limestone Member of Reynolds (1953) and this was followed by Cooper (1979), though not by Jenkins *et al.* (1982), whose nomenclature is used in this paper. Fig. 1 summarizes this stratigraphy.

About ten years ago the beach at Maslin Bay was proclaimed available for nude bathing and this factor has deterred some study groups from visiting the stratotype area. Also, an equivalent section at Whitton Bluff, Christies Beach, is no longer accessible for study due to coastal protection works. There is therefore a need for nomination of other outcrops as reference sections of the Tertiary units.

* Department of Geology, University of Adelaide, G.P.O. Box 498, Adelaide, S. Aust. 5001.

† School of Pure and Applied Sciences, S.A.C.A.E. (Salisbury Campus), Smith Road, Salisbury East, S. Aust. 5109.

‡ Centre for Environmental Studies, University of Adelaide, G.P.O. Box 498, Adelaide, S. Aust. 5001.

[1] Beecroft, A. S. (1980) Foraminiferal biofacies of the Tortachilla Limestone and the Blanche Point Formation, Late Eocene, Willunga Sub-basin, South Australia. B.A.(Hons.) thesis, Univ. of Adelaide.

Outcrop descriptions

Daily (1952)[2] noted outcrops of Tertiary sediments of the Noarlunga Embayment in cliffs and road cuttings adjacent to the lower Onkaparinga River. More recently, additional road works have exposed these strata in greater detail (Stocksiek 1983[3]). An exposure on River Road (Fig. 2, Site 1) presents more than 100 metres of easily accessible and continuous outcrop. Part of this exposure is shown in Fig. 3.

From road level, yellow-brown clays give way to coarse, limonitic, crossbedded sandstone, apparently non-fossiliferous. These sediments have a thickness of about 2.5 metres and are characteristic of the South Maslin Sand Member. Overlying Tortachilla Limestone, typically glauconitic green, sandy and richly fossiliferous, is 1–2 metres thick. Glauconitic marls of the Tuketja Member form the uppermost beds of the outcrop. These three outcropping units are essentially similar in lithological detail to descriptions of stratotype material given in Cooper (1979). Because of ease of access and clarity of stratigraphic boundaries, this exposure is here proposed as a reference section for the Tortachilla Limestone. Fossil foraminifera from the section are discussed later below.

In roadside outcrop west of the Reference Section (Fig. 2, Site 2) only 0.5 metre of South Maslin Sand Member appears above road level. Tortachilla Limestone is bleached and its upper boundary is indistinct. Tuketja Member constitutes most of the outcrop, though the higher, harder, more prominent beds may represent the Gull Rock Member of the

[2] Daily, B. (1952) Stratigraphy and geology of the Noarlunga basin. B.Sc.(Hons.) thesis, Univ. of Adelaide.

[3] Stocksiek, C. (1983) Some observations of the Tertiary strata outcropping adjacent to the Onkaparinga estuary, South Australia. Geology project report, S. Aust. Coll. Adv. Educ., Salisbury.

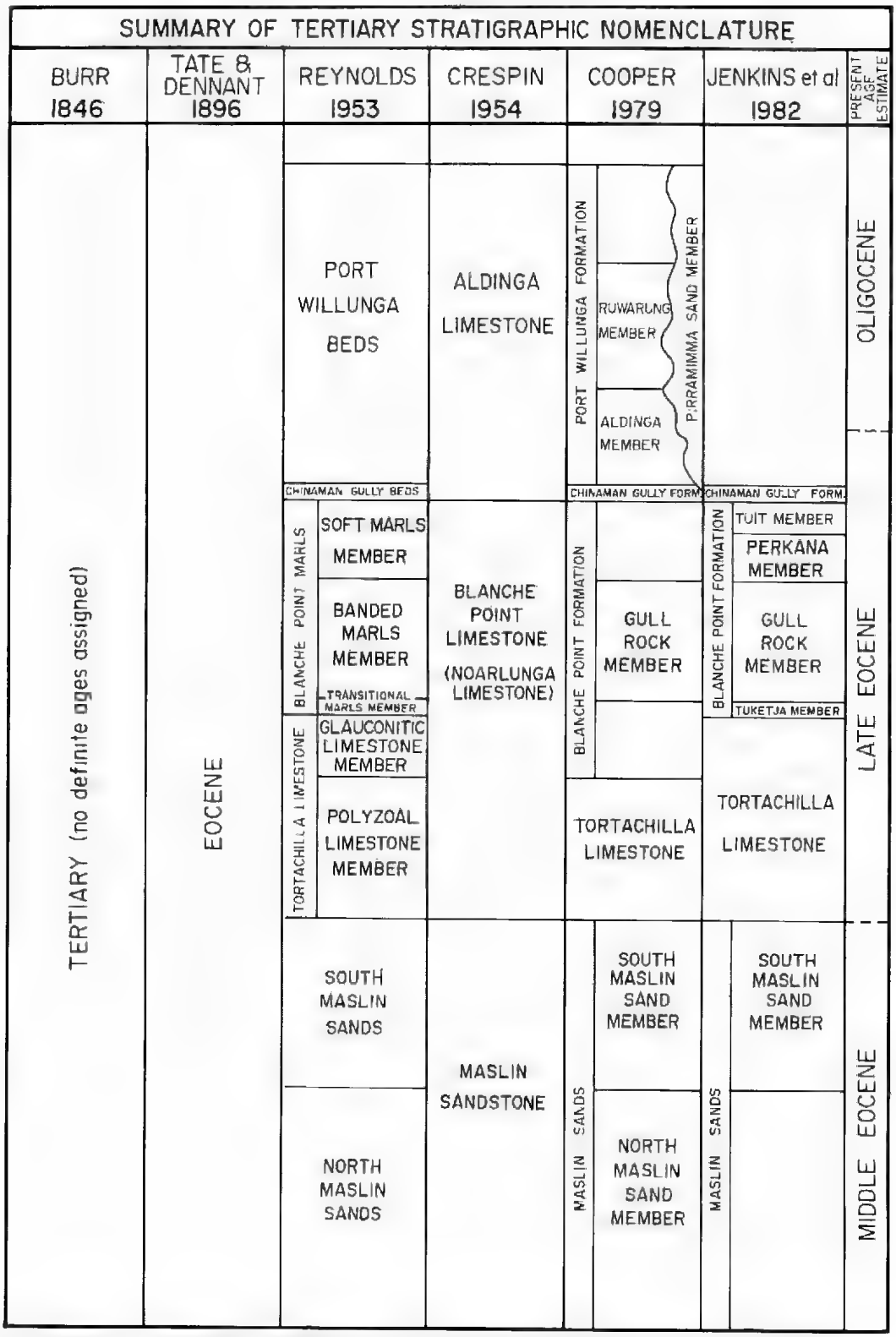

Fig. 1. Summary of stratigraphic nomenclature for St Vincent Basin, South Australia. No scale implied.

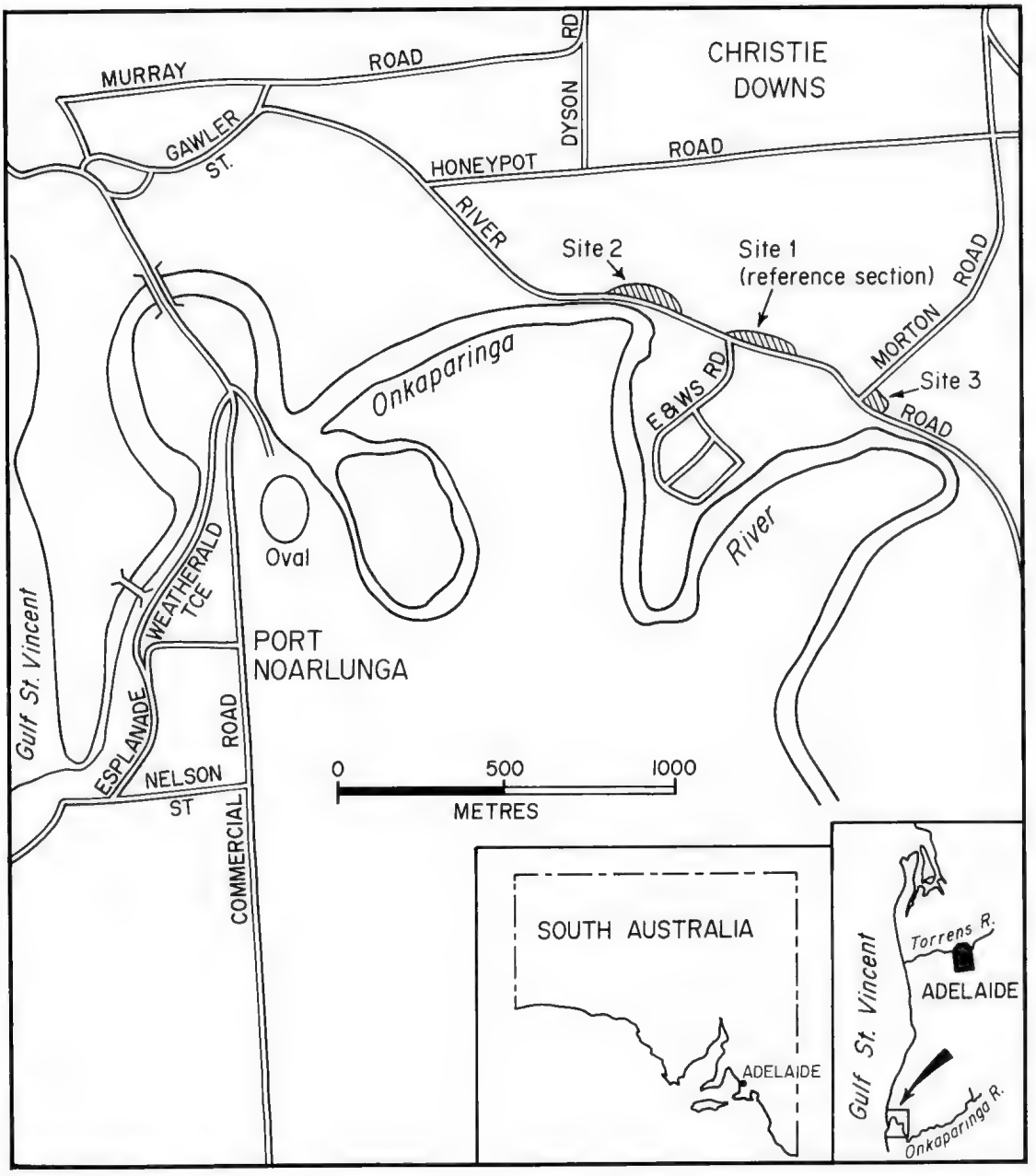

Fig. 2. Location map showing sites of outcrop of Tertiary sediments referred to in text.

the Blanche Point Formation. The sequence apparently dips gently westwards.

At the intersection of Morton and River Roads (Fig. 2, Site 3) Tortachilla Limestone outcrops prominently. It is conspicuously fossiliferous (Fig. 4) and overlain by both Tuketja and Gull Rock Members of the Blanche Point Formation.

Foraminifera

Microscopic examination of washed material from the identified Tortachilla Limestone at Site 1 revealed a rich micro-fauna dominated by benthic foraminifera, with occasional ostracods. Scanning electron photomicrographs of some species of the foraminifera are shown in Fig. 5. A similar

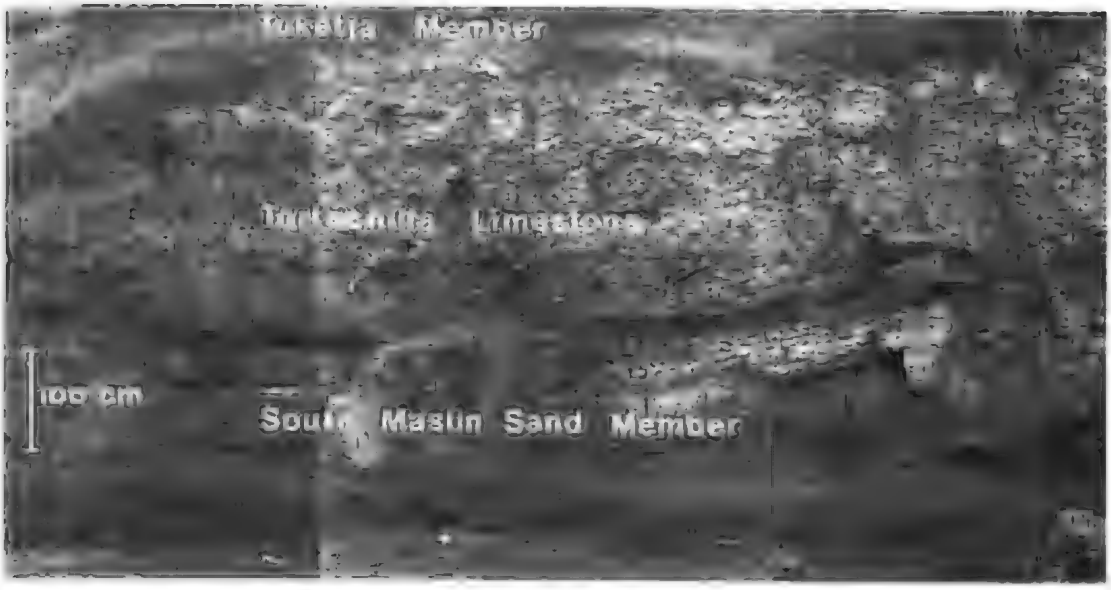

Fig. 3. Composite photography of part of the proposed reference section for the Tortachilla Limestone.

foraminiferal assemblage occurs at Maslin Bay in stratotype Tortachilla Limestone and has been referred to Zone P15 (Lindsay 1981,[4] and refs. therein).

Significant planktonic foraminifera present include: *Subbotina linaperta, S. angiporoides, Tenuitella aculeata, T. gemma, T. insolita, Turborotalia nana, T. centralis, T. cerroazulensis, Chiloguembelina cubensis, Pseudohastigerina micra* and *Globigerinatheka index*. The lower disjunct top to *Tenuitella aculeata* occurs within this unit, while *Turborotalia cerroazulensis* has only recently been found in the type section (Lindsay 1981) and is not known with any certainty to occur locally above the Tortachilla Limestone.

Among the benthic foraminifera, the presence of *Pseudopolymorphina carteri, Linderina glaessneri* and *Maslinella chapmani* is significant. *Pseudopolymorphina carteri* is restricted in occurrence to the Tortachilla Limestone and basal Blanche Point Formation (Tuketja Member) at Maslin Bay, while the presence of *Linderina glaessneri* at this level represents an extra-tropical excursion (Lindsay 1967, 1969; McGowran 1978). The presence of *Maslinella chapmani* appears to be temperature controlled, being found in the Tortachilla Limestone and Tuketja Member, and then not again until the basal part of the Aldinga Member of the Port Willunga Formation (P16) where *L. glaessneri* also reappears briefly.

[4] Lindsay, J. M. (1981) tertiary stratigraphy and foraminifera, Adelaide, South Australia. M.Sc. thesis, Univ. of Adelaide.

The remainder of the assemblage are species which cover a wider stratigraphic range, but as an assemblage, the unit contains both planktonic and benthic elements which are consistent with stratotype Tortachilla Limestone.

The overlying unit contains rare, small, broken, but nonetheless unambiguous *Hantkenina primitiva*, which unequivocally confirms that this unit is the Tuketja Member of the Blanche Point Formation, and hence supports the identification of the Tortachilla Limestone unit. The Tuketja Member here does not contain *T. aculeata* nor *L. glaessneri*, consistent with the type section at Maslin Bay, although *P. carteri* and *M. chapmani* are present in reduced numbers.

Conclusions

The presence of key species, in particular *Tenuitella aculeata, Turborotalia cerroazulensis, T. centralis, Pseudopolymorphina carteri, Maslinella chapmani* and *Linderina glaessneri* enable this unit to be recognized stratigraphically as Tortachilla Limestone. Identification is further emphasised by the presence of *Hantkenina primitiva* in the overlying unit, which is thus confirmed as being the Tuketja Member of the Blanche Point Formation.

The foraminiferal fauna of the Tortachilla Limestone enables correlation with the equivalent level in the Browns Creek section of south-western Victoria and the Nanarup Limestone of the Bremer Basin, Western Australia (McGowran & Beecroft in prep.).

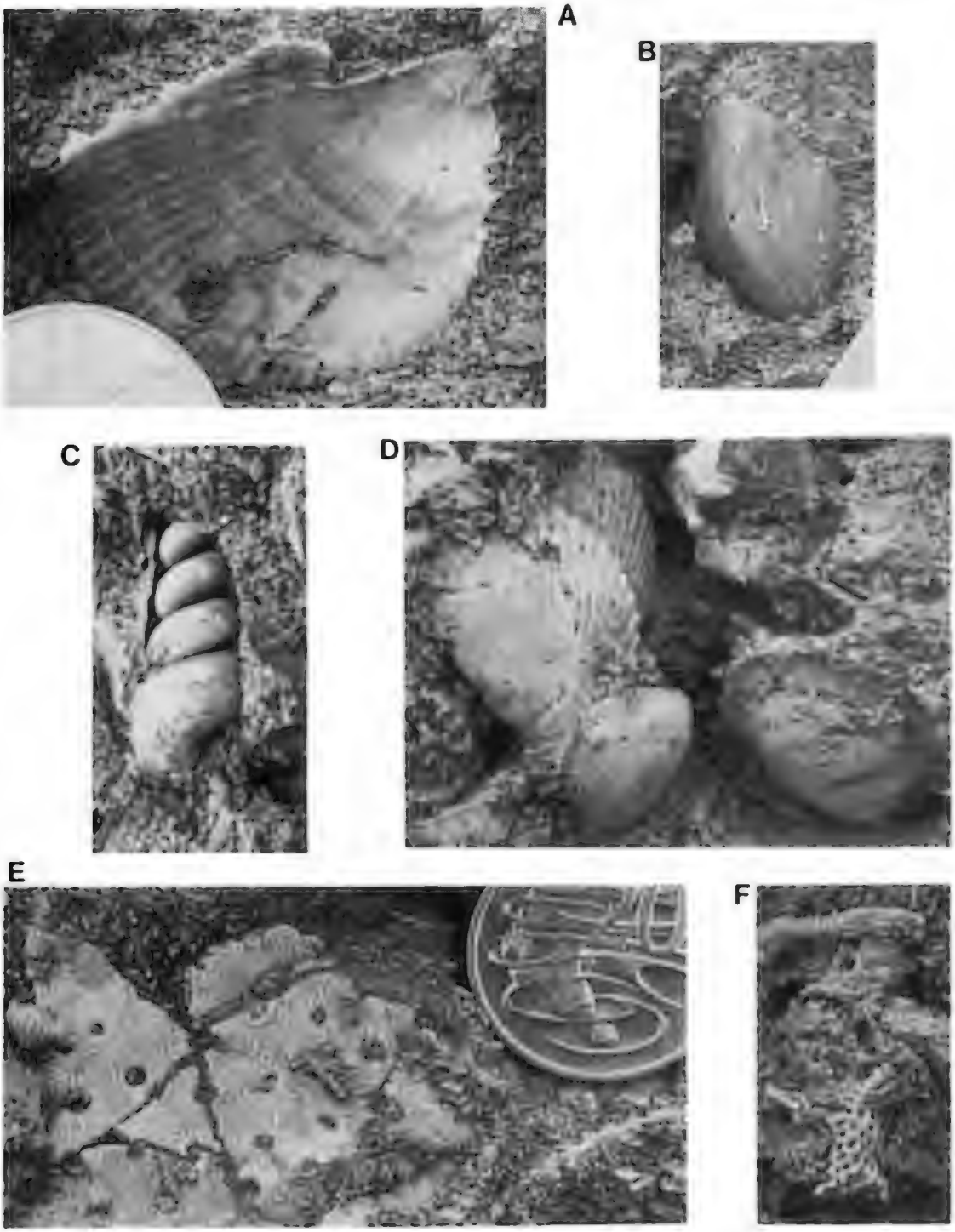

Fig. 4. Selected fossils, photographed at outcrop of the Tortachilla Limestone at site 3. A and D, bivalves; B, brachiopod; C, gastropod; E and F, bryozoa. all × 1.5 approx. (diameter of Aust. 20 cents coin is 28 mm).

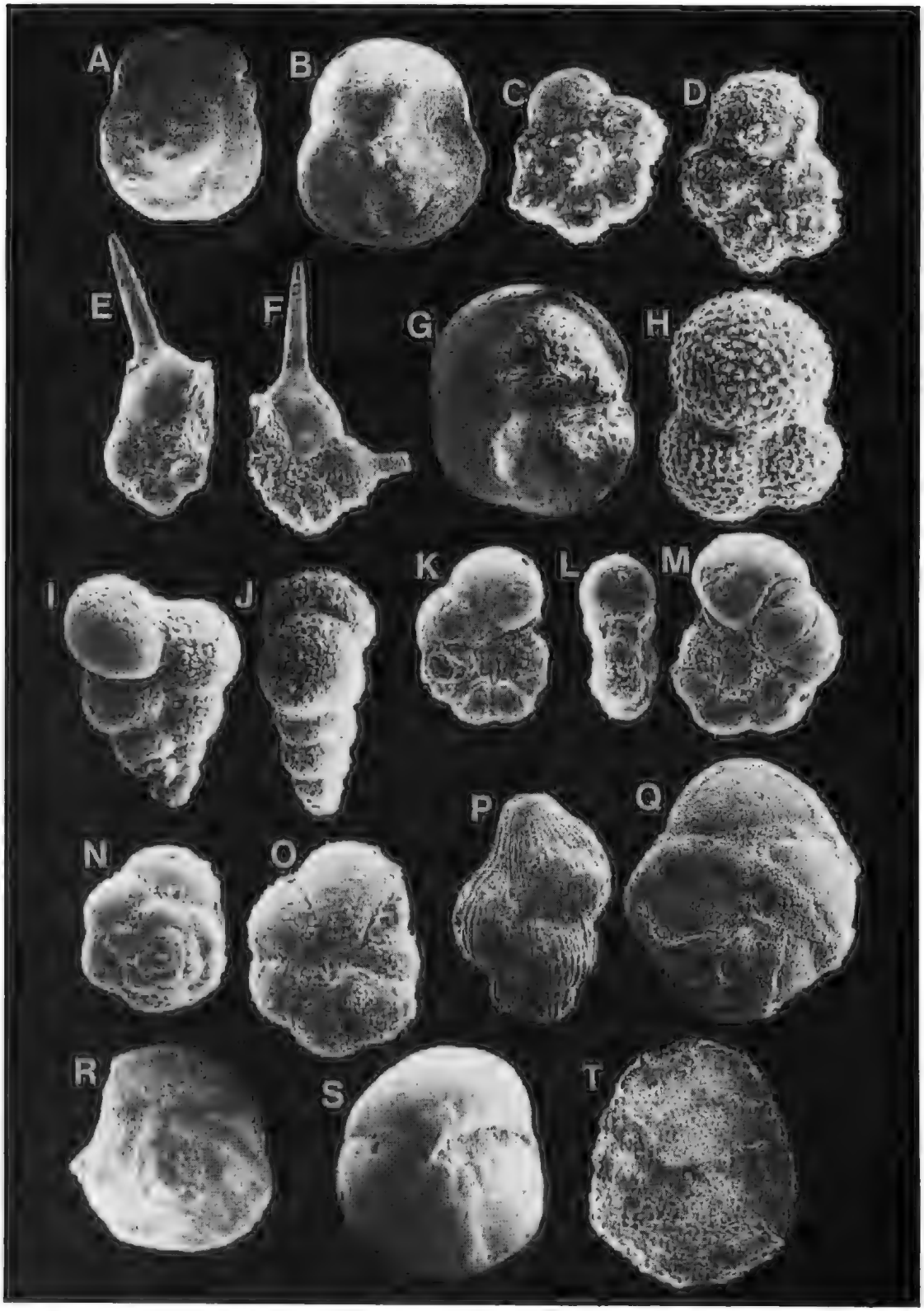
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Fig. 5. Selected foraminifera from the Tortachilla Limestone at the proposed reference section. A, B *Turborotalia cerroazulensis* (Cole) × 75; C, D *Tenuitella aculeata* (Jenkins) × 220; E, F *Hantkenina primitiva* Cushman and Jarvis × 120; G *Globigerinatheka index* (Finlay) × 145; H *Subbotina angiporoides* (Hornibrook) × 220; I, J *Chiloguembelina cubensis* (Palmer) × 220; K, L, M *Pseudohastigerina micra* (Cole) × 145; N, O *T. insolita* (Jenkins) × 220; P *Pseudopolymorphina carteri* Quilty × 27; Q *Stomatorbina concentrica* (Cushman and Bermudez) × 65; R, S *Eponides repandus* Fichell and Moll) × 45; T *Linderina glaessneri* Quilty × 27.

A COMPARATIVE ANALYSIS OF EOCENE/OLIGOCENE BOUNDARY OSTRACODA FROM SOUTHEASTERN AUSTRALIA AND INDIA WITH RESPECT TO THEIR USEFULNESS AS INDICATORS OF PETROLEUM POTENTIAL

BY K. G. MCKENZIE $ D. K. GUHA†*

Summary

Eocene/Oligocene boundary Ostracoda were analysed from selected wells in the Adelaide Plains Sub-Basin, South Australia and Cambay Basin, India. Source-rock characteristics of the sequences were determined - based mainly on ostracode parameters, with some additional information coming from their glauconite and gypsum content. Numerically similar ostracode counts were made for both sets of samples. The parameters studied were: carapace/valves ratio; adults/juveniles ratio; percentage of fragments; percentage of crushed and worn specimens; *Krithe* type; percentage of pyritised specimens.

Results (which concur with exploration results to date) indicate that the Eocene/Oligocene boundary zone sediments have little petroleum potential in South Australia, but high potential in India. This conclusion was largely reinforced when the South Australian borehole Ostracoda were analysed in more detail. Consistent results were also obtained when the same parameters were determined for Ostracoda in outcrop samples collected from Aldinga Bay, South Australia.

KEY WORDS: Ostracoda, petroleum indices, Eocene/Oligocene boundary, South Australia, India.